FIG. 1

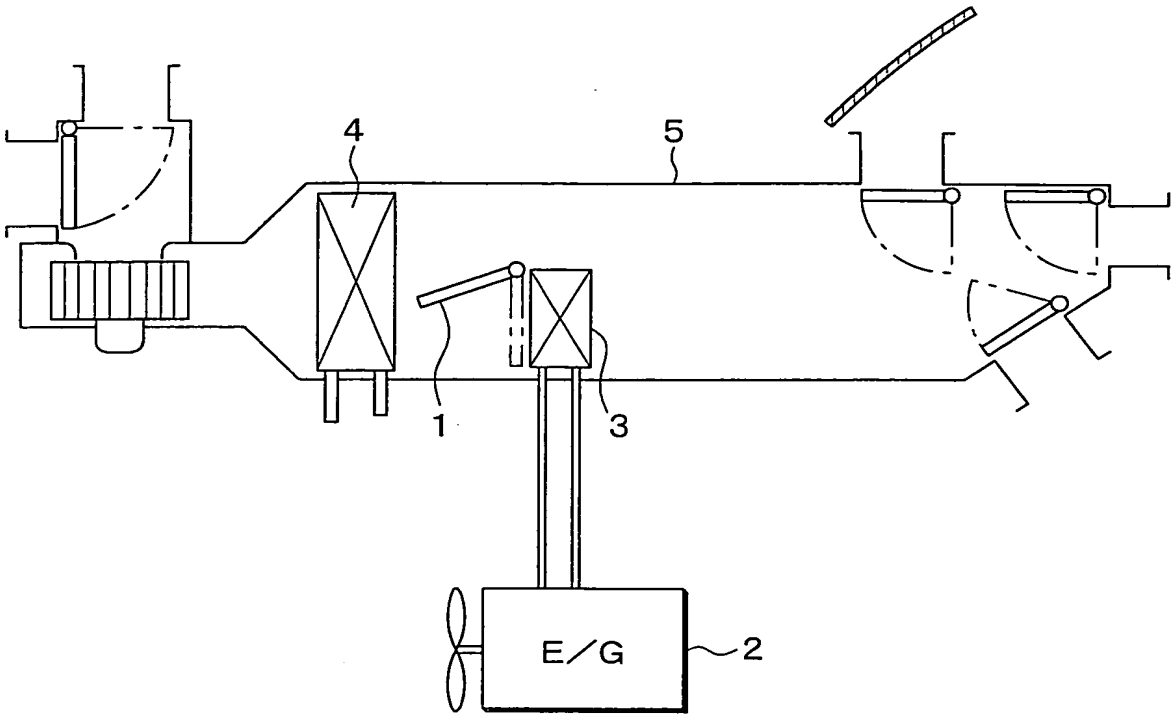


FIG. 2A

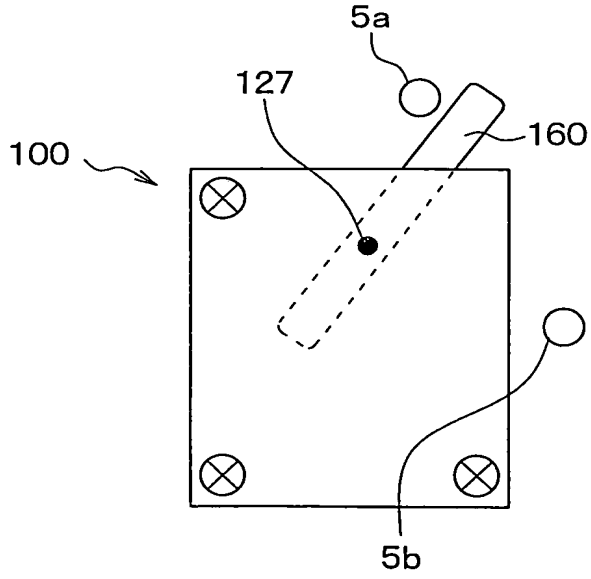


FIG. 2B

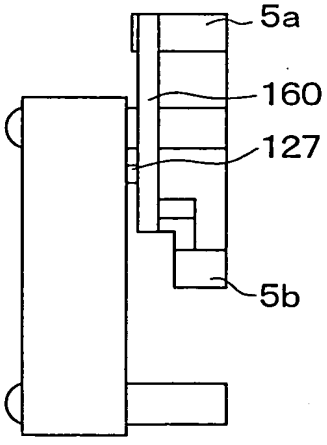


FIG. 3

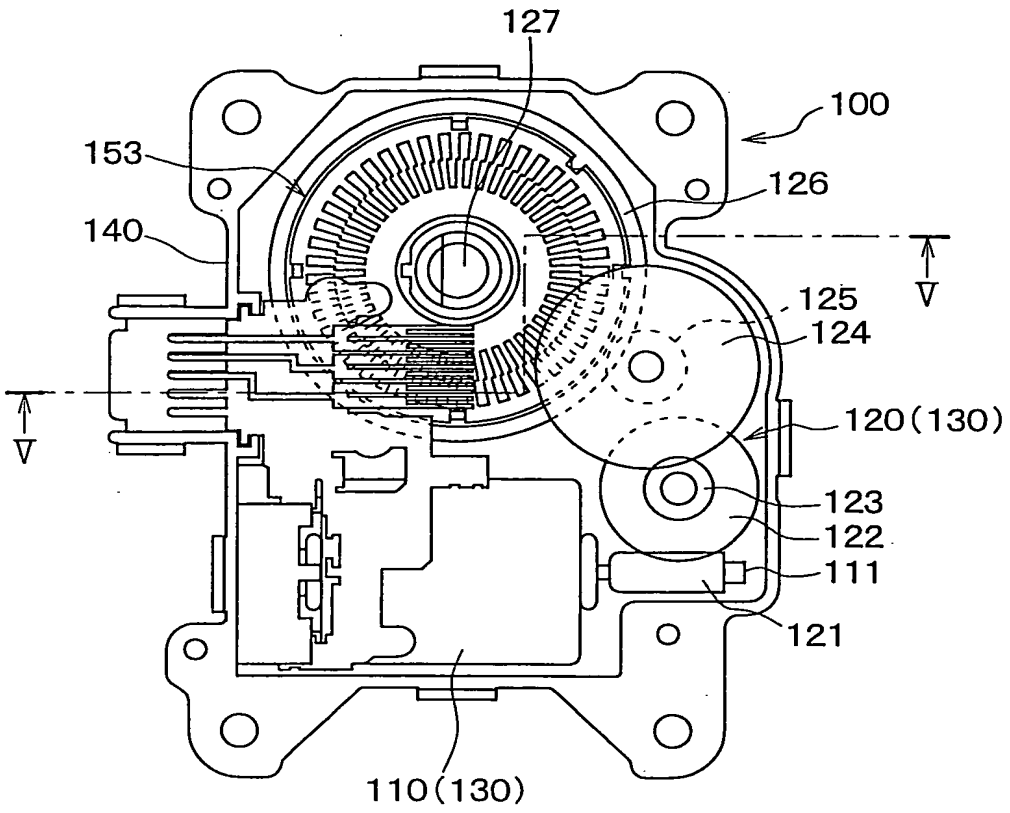


FIG. 4A

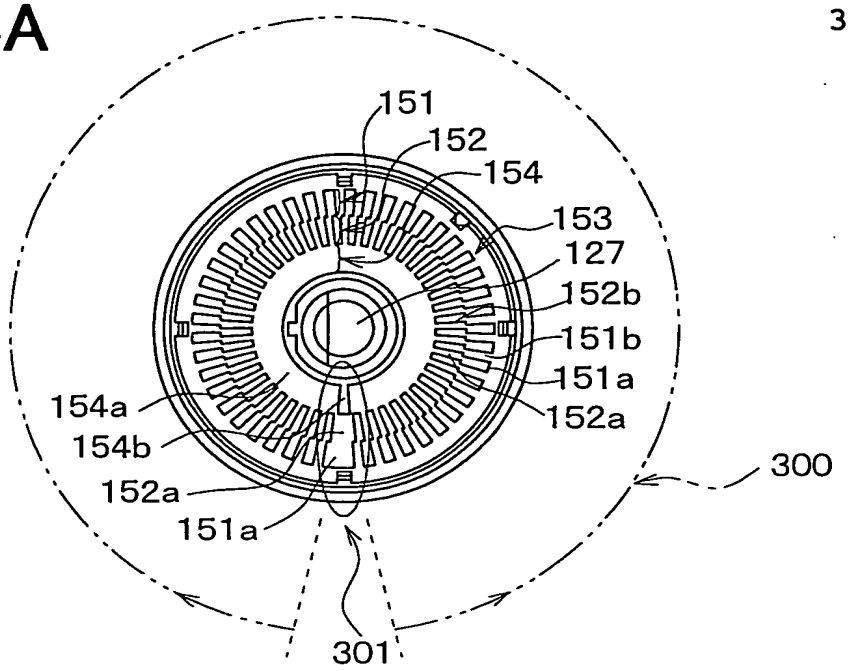


FIG. 4B

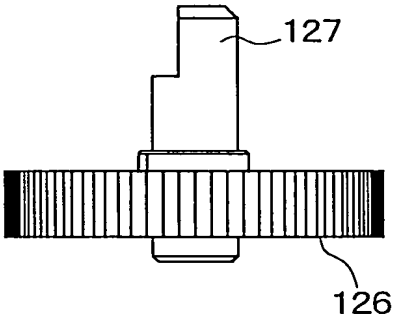
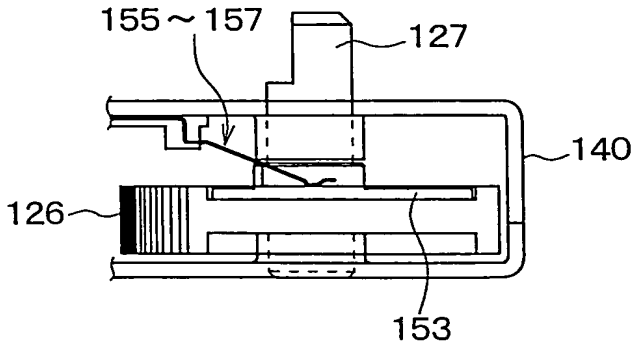


FIG. 5



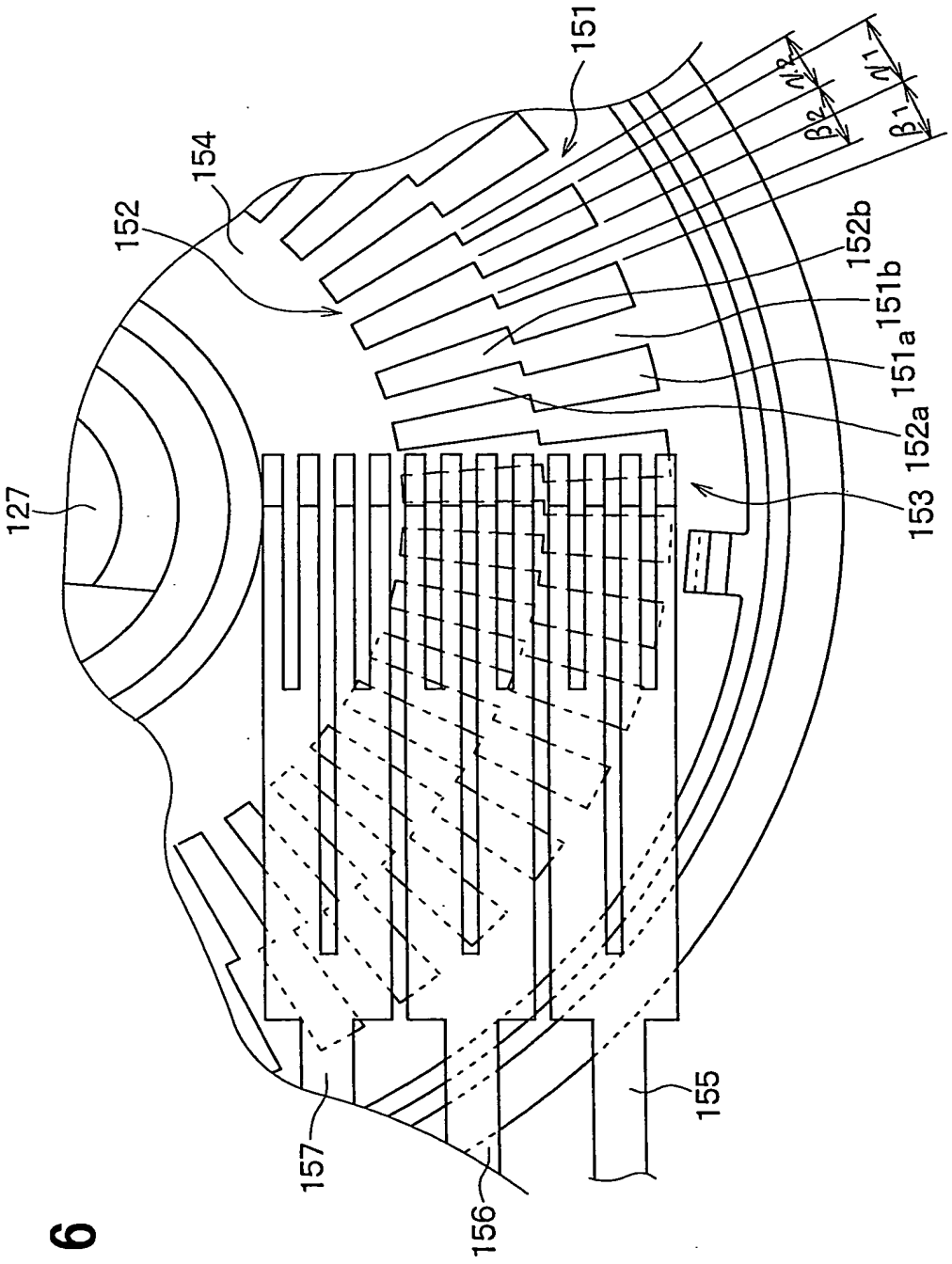


FIG. 6

FIG. 7

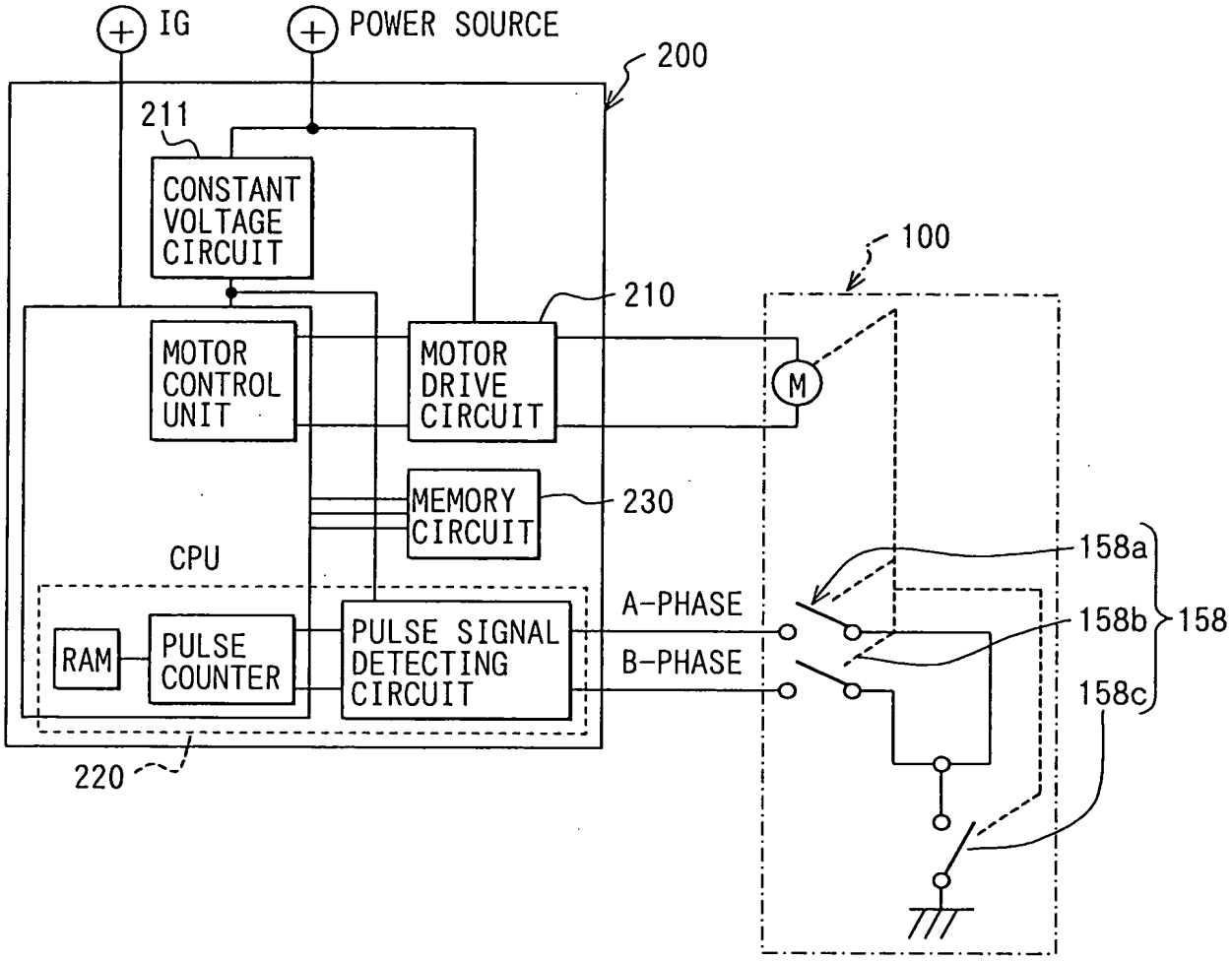

IG
POWER SOURCE
200
211
CONSTANT VOLTAGE CIRCUIT
100
210
MOTOR CONTROL UNIT
MOTOR DRIVE CIRCUIT
M
MEMORY CIRCUIT
230
CPU
158a
158b
158
158c
A-PHASE
B-PHASE
RAM
PULSE COUNTER
PULSE SIGNAL DETECTING CIRCUIT
220

FIG. 8

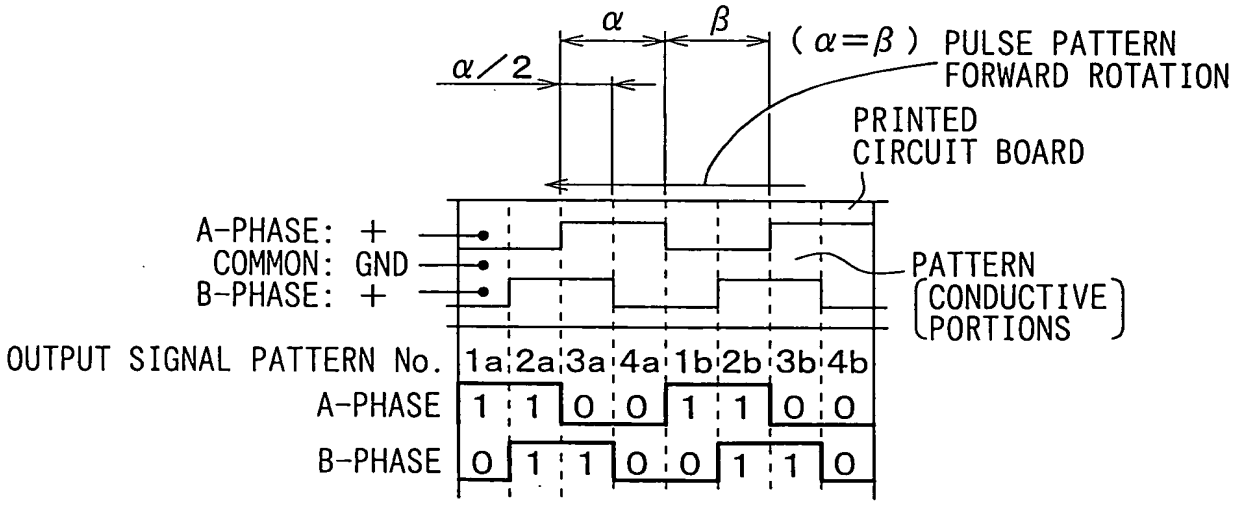

α
β
(α=β)
PULSE PATTERN FORWARD ROTATION
α/2
PRINTED CIRCUIT BOARD
A-PHASE: +
COMMON: GND
B-PHASE: +
PATTERN
CONDUCTIVE PORTIONS
OUTPUT SIGNAL PATTERN No.
1a 2a 3a 4a 1b 2b 3b 4b
A-PHASE
1 1 0 0 1 1 0 0
B-PHASE
0 1 1 0 0 1 1 0

FIG. 9

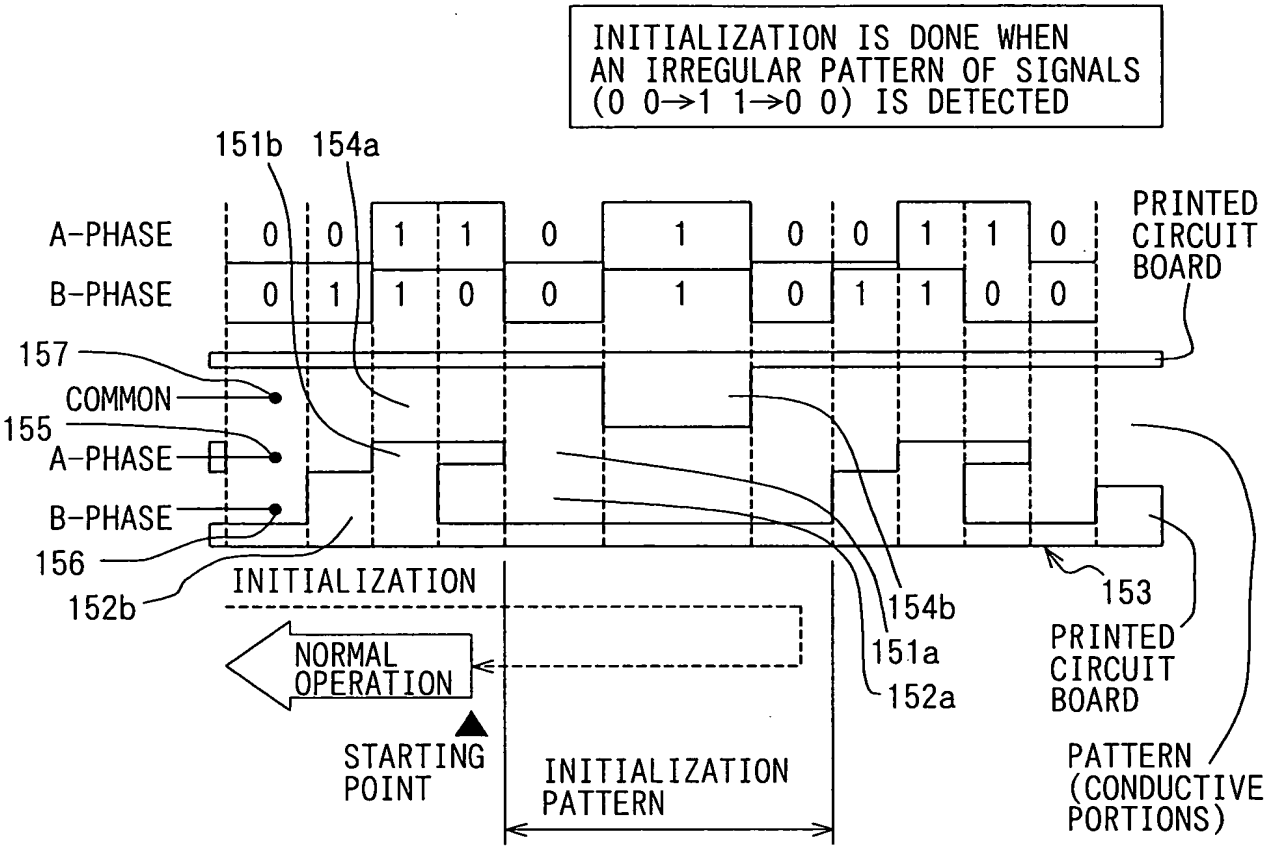

INITIALIZATION IS DONE WHEN
AN IRREGULAR PATTERN OF SIGNALS
(0 0→1 1→0 0) IS DETECTED
151b
154a
A-PHASE
B-PHASE
0 0 1 1 0 1 0 0 1 1 0
0 1 1 0 0 1 0 1 1 0 0
PRINTED CIRCUIT BOARD
157
COMMON
155
A-PHASE
B-PHASE
156
152b
INITIALIZATION
NORMAL OPERATION
STARTING POINT
INITIALIZATION PATTERN
154b
151a
152a
153
PRINTED CIRCUIT BOARD
PATTERN (CONDUCTIVE PORTIONS)

FIG. 10

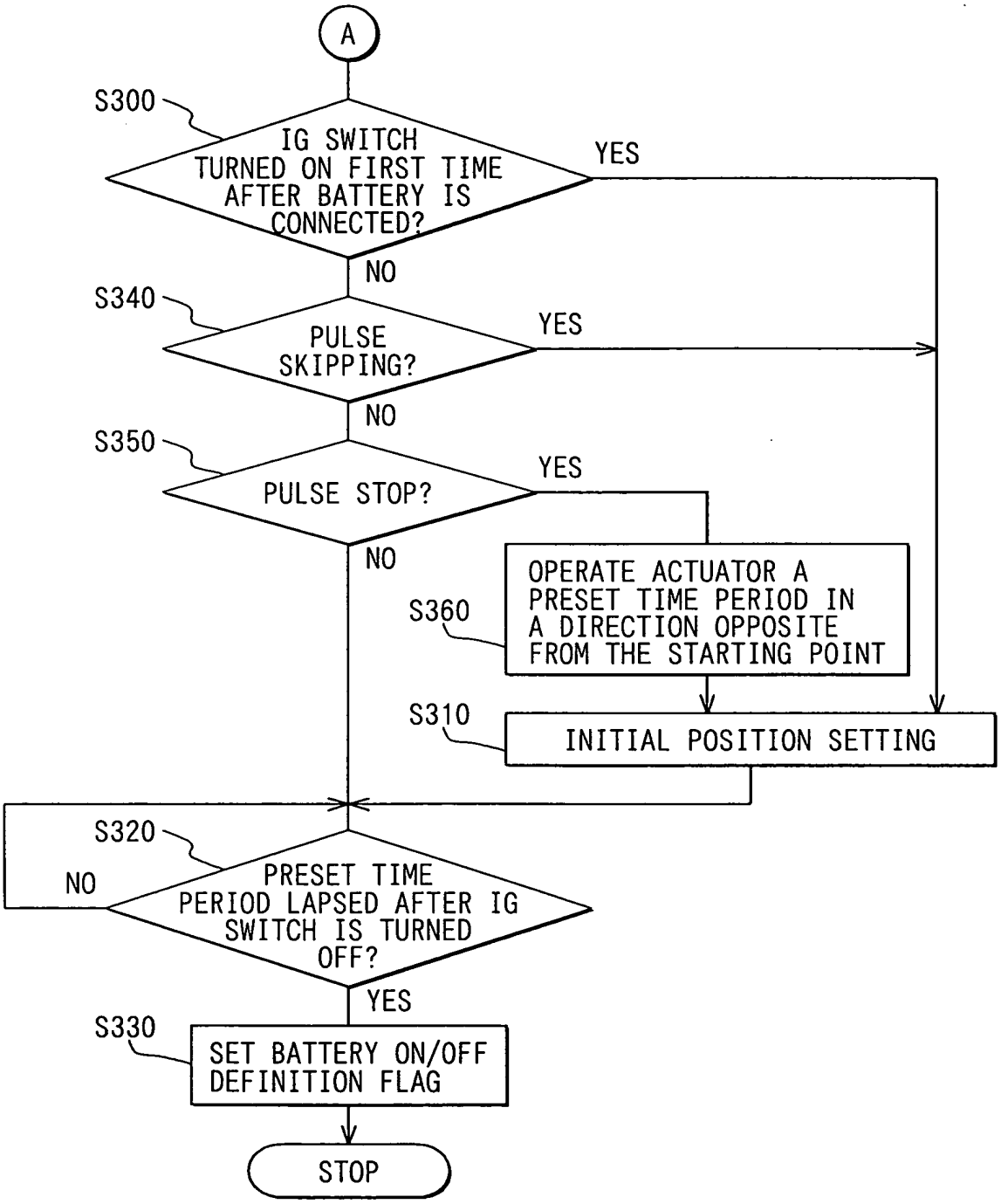

A
S300
IG SWITCH TURNED ON FIRST TIME AFTER BATTERY IS CONNECTED?
YES
NO
S340
PULSE SKIPPING?
YES
NO
S350
PULSE STOP?
YES
NO
S360
OPERATE ACTUATOR A PRESET TIME PERIOD IN A DIRECTION OPPOSITE FROM THE STARTING POINT
S310
INITIAL POSITION SETTING
S320
NO
PRESET TIME PERIOD LAPSED AFTER IG SWITCH IS TURNED OFF?
YES
S330
SET BATTERY ON/OFF DEFINITION FLAG
STOP

FIG. 11

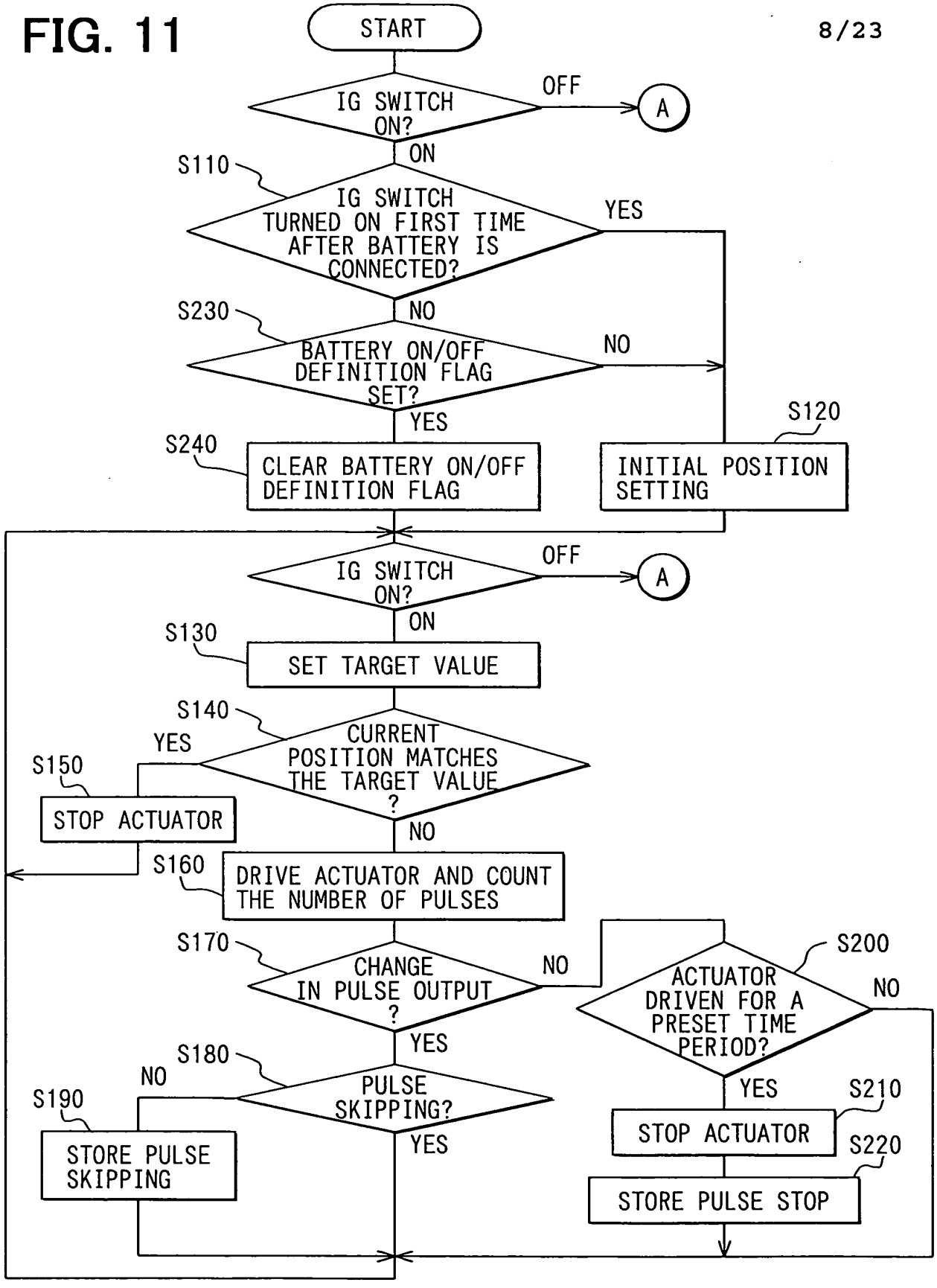

START
IG SWITCH ON?
OFF
A
ON
S110
IG SWITCH TURNED ON FIRST TIME AFTER BATTERY IS CONNECTED?
YES
NO
S230
BATTERY ON/OFF DEFINITION FLAG SET?
NO
YES
S240
CLEAR BATTERY ON/OFF DEFINITION FLAG
S120
INITIAL POSITION SETTING
IG SWITCH ON?
OFF
A
ON
S130
SET TARGET VALUE
S140
CURRENT POSITION MATCHES THE TARGET VALUE ?
YES
S150
STOP ACTUATOR
NO
S160
DRIVE ACTUATOR AND COUNT THE NUMBER OF PULSES
S170
CHANGE IN PULSE OUTPUT ?
NO
YES
S180
PULSE SKIPPING?
NO
YES
S190
STORE PULSE SKIPPING
S200
ACTUATOR DRIVEN FOR A PRESET TIME PERIOD?
NO
YES
S210
STOP ACTUATOR
S220
STORE PULSE STOP

FIG. 12A

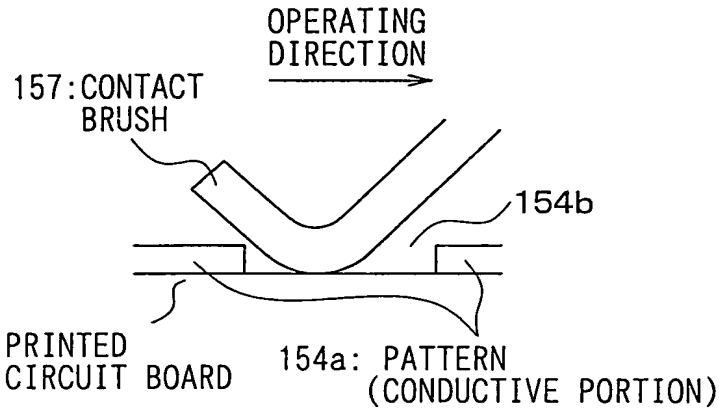


FIG. 12B

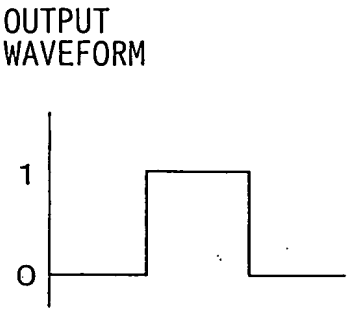


FIG. 12C

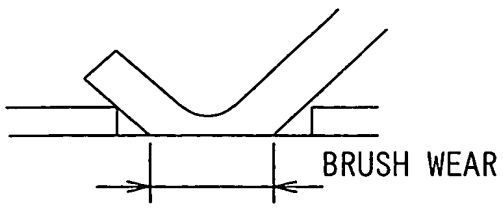


FIG. 12D

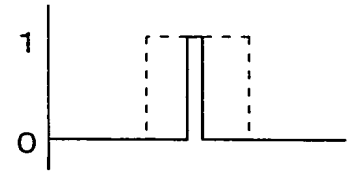


FIG. 13

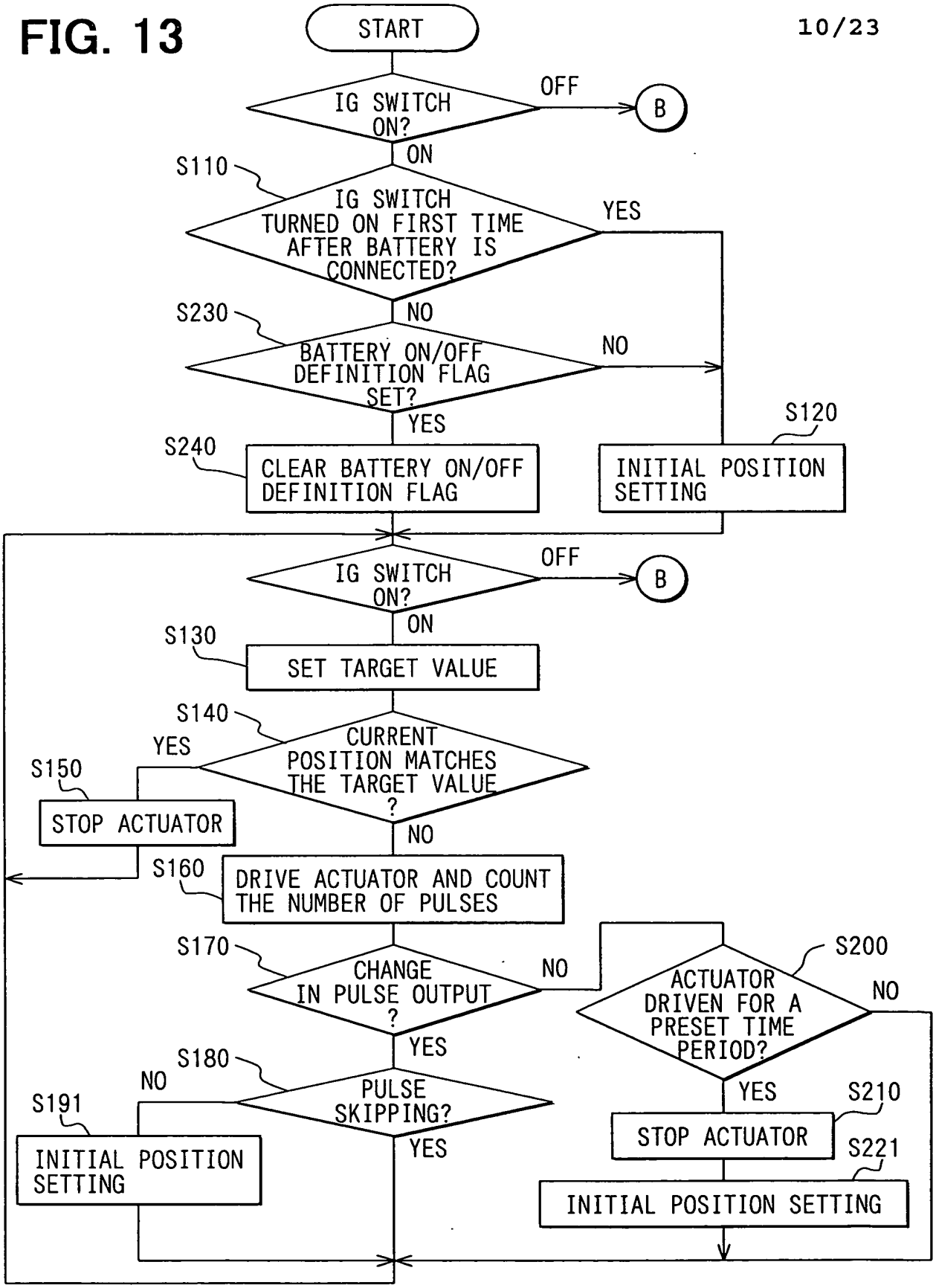

START
IG SWITCH ON?
OFF
B
ON
S110
IG SWITCH TURNED ON FIRST TIME AFTER BATTERY IS CONNECTED?
YES
NO
S230
BATTERY ON/OFF DEFINITION FLAG SET?
NO
YES
S240
CLEAR BATTERY ON/OFF DEFINITION FLAG
S120
INITIAL POSITION SETTING
IG SWITCH ON?
OFF
B
ON
S130
SET TARGET VALUE
S140
CURRENT POSITION MATCHES THE TARGET VALUE ?
YES
S150
STOP ACTUATOR
NO
S160
DRIVE ACTUATOR AND COUNT THE NUMBER OF PULSES
S170
CHANGE IN PULSE OUTPUT ?
NO
YES
S200
ACTUATOR DRIVEN FOR A PRESET TIME PERIOD?
NO
YES
S180
PULSE SKIPPING?
NO
YES
S191
INITIAL POSITION SETTING
S210
STOP ACTUATOR
S221
INITIAL POSITION SETTING

FIG. 14

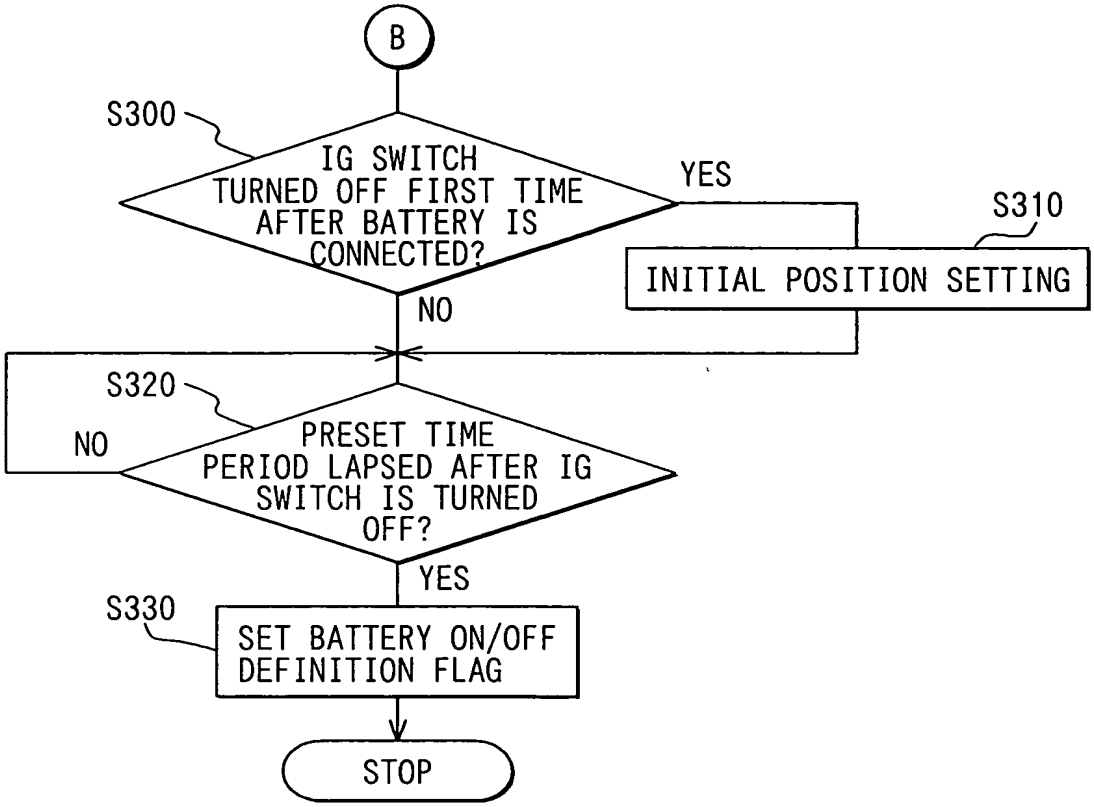

B
S300
IG SWITCH TURNED OFF FIRST TIME AFTER BATTERY IS CONNECTED?
YES
S310
INITIAL POSITION SETTING
NO
S320
NO
PRESET TIME PERIOD LAPSED AFTER IG SWITCH IS TURNED OFF?
YES
S330
SET BATTERY ON/OFF DEFINITION FLAG
STOP

FIG. 15

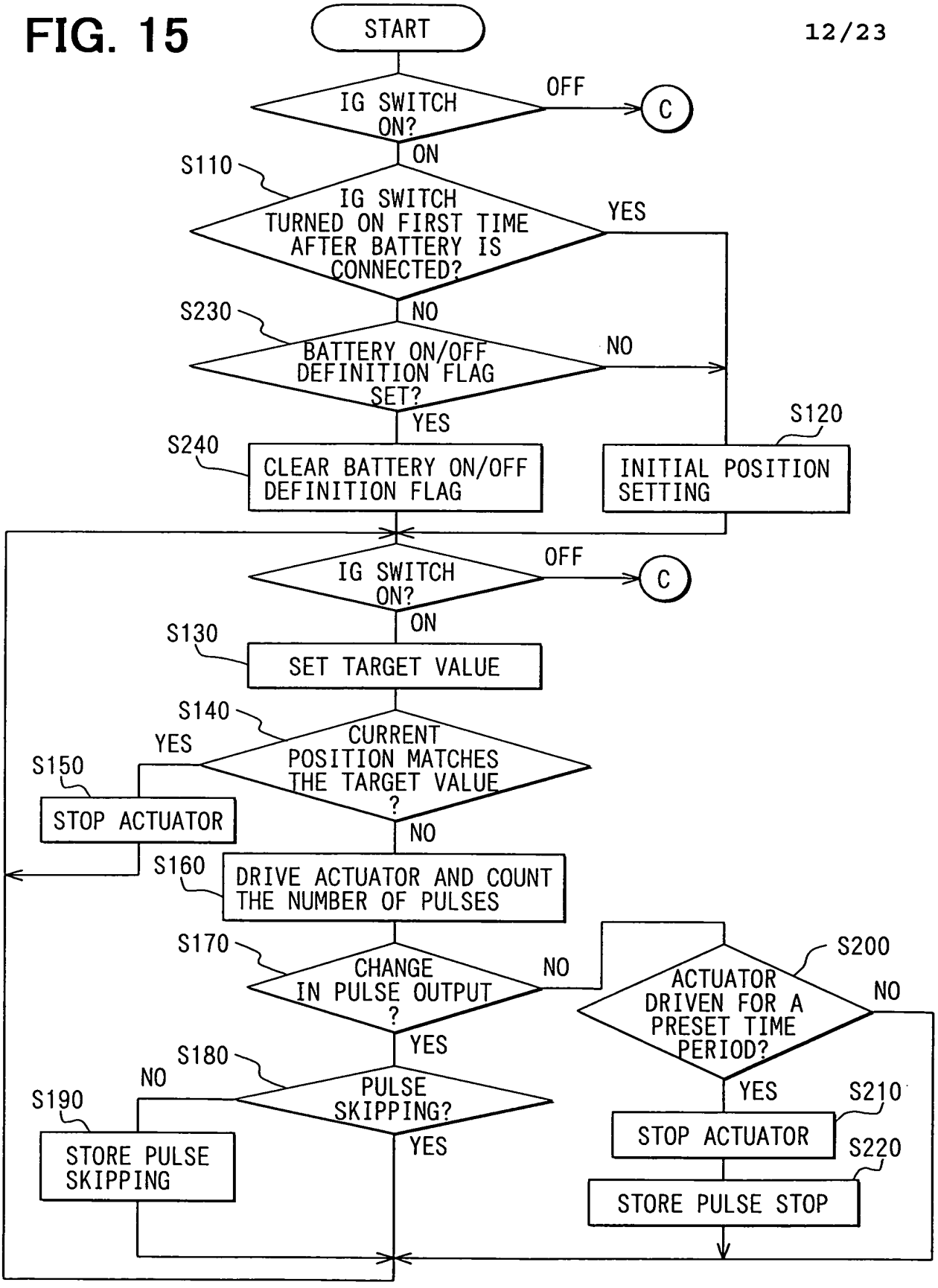

START
IG SWITCH ON?
OFF
C
ON
S110
IG SWITCH TURNED ON FIRST TIME AFTER BATTERY IS CONNECTED?
YES
NO
S230
BATTERY ON/OFF DEFINITION FLAG SET?
NO
YES
S240
CLEAR BATTERY ON/OFF DEFINITION FLAG
S120
INITIAL POSITION SETTING
IG SWITCH ON?
OFF
C
ON
S130
SET TARGET VALUE
S140
CURRENT POSITION MATCHES THE TARGET VALUE ?
YES
S150
STOP ACTUATOR
NO
S160
DRIVE ACTUATOR AND COUNT THE NUMBER OF PULSES
S170
CHANGE IN PULSE OUTPUT ?
NO
YES
S180
PULSE SKIPPING?
NO
S190
STORE PULSE SKIPPING
YES
S200
ACTUATOR DRIVEN FOR A PRESET TIME PERIOD?
NO
YES
S210
STOP ACTUATOR
S220
STORE PULSE STOP

FIG. 16

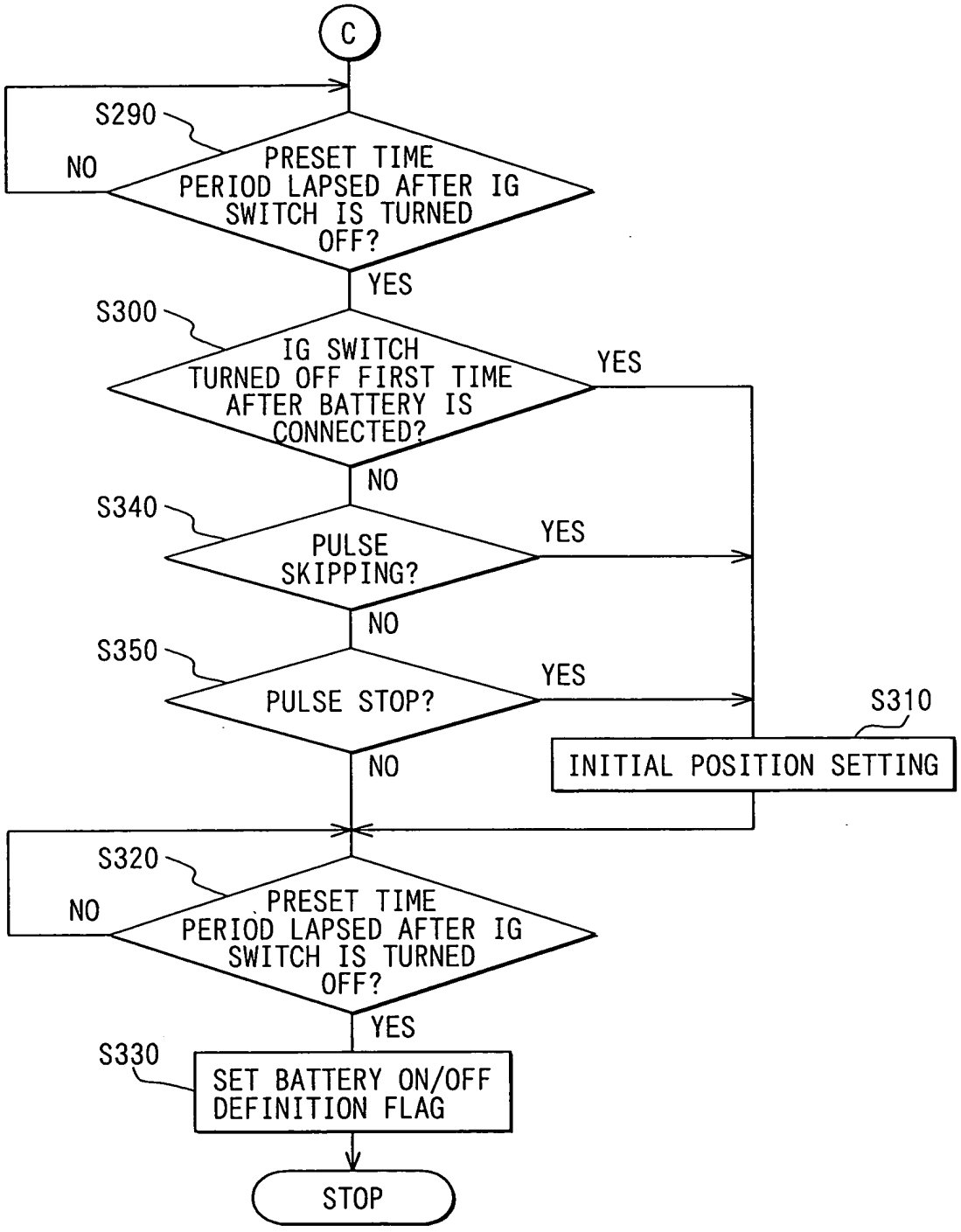

C
S290
PRESET TIME PERIOD LAPSED AFTER IG SWITCH IS TURNED OFF?
NO
YES
S300
IG SWITCH TURNED OFF FIRST TIME AFTER BATTERY IS CONNECTED?
YES
NO
S340
PULSE SKIPPING?
YES
NO
S350
PULSE STOP?
YES
NO
S310
INITIAL POSITION SETTING
S320
PRESET TIME PERIOD LAPSED AFTER IG SWITCH IS TURNED OFF?
NO
YES
S330
SET BATTERY ON/OFF DEFINITION FLAG
STOP

FIG. 17

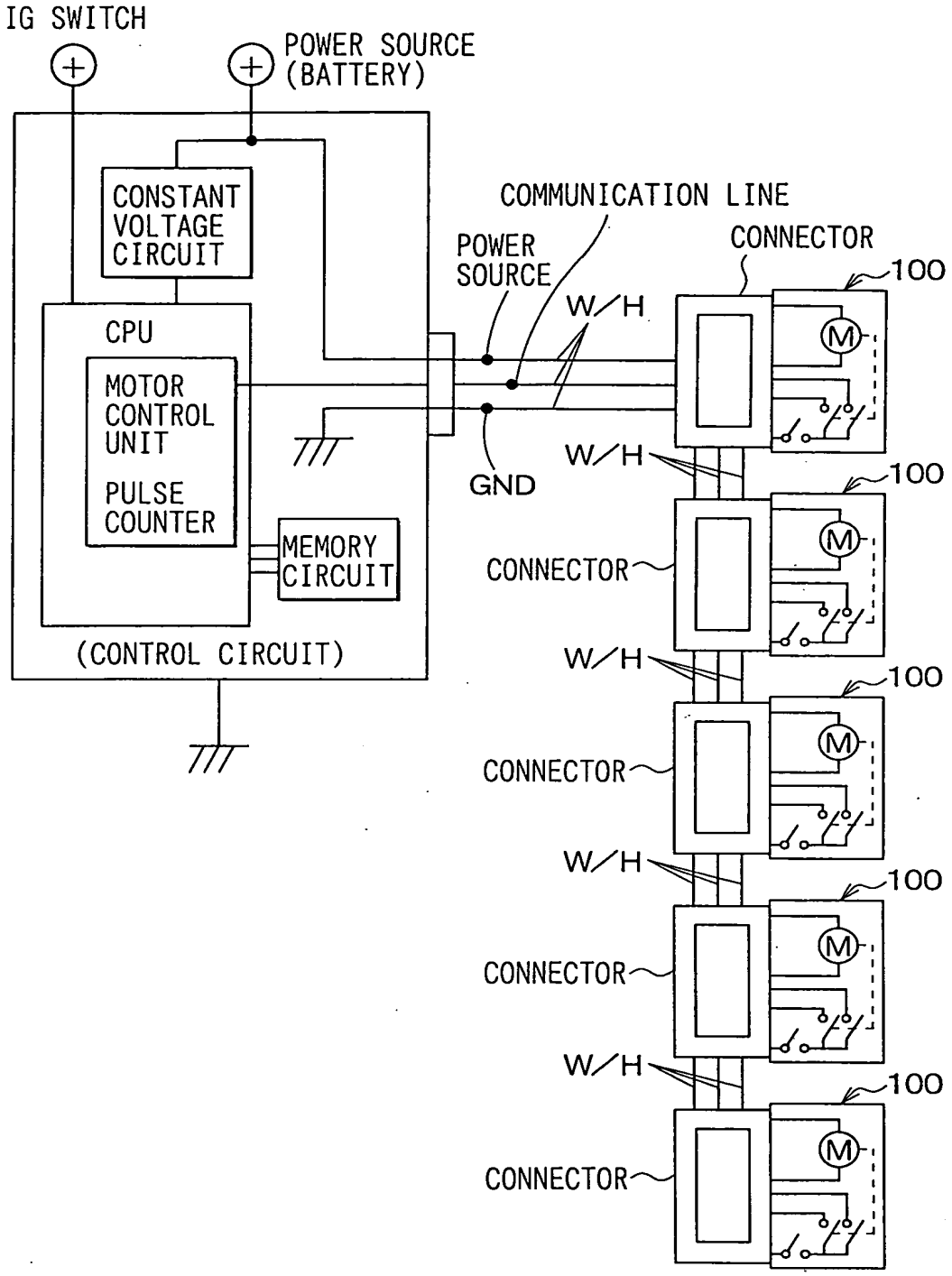

IG SWITCH
POWER SOURCE (BATTERY)
CONSTANT VOLTAGE CIRCUIT
CPU
MOTOR CONTROL UNIT
PULSE COUNTER
MEMORY CIRCUIT
(CONTROL CIRCUIT)
COMMUNICATION LINE
POWER SOURCE
GND
W/H
CONNECTOR
100
M

FIG. 18

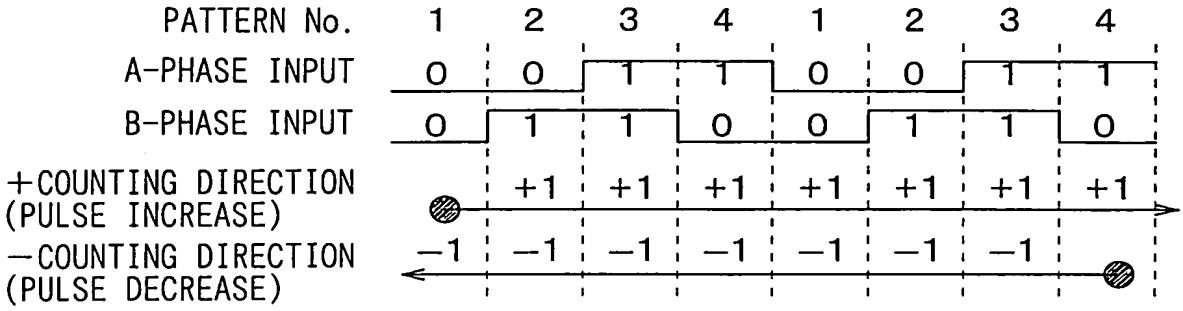

PATTERN No.
1 2 3 4 1 2 3 4
A-PHASE INPUT
0 0 1 1 0 0 1 1
B-PHASE INPUT
0 1 1 0 0 1 1 0
+COUNTING DIRECTION
(PULSE INCREASE)
+1 +1 +1 +1 +1 +1 +1
−COUNTING DIRECTION
(PULSE DECREASE)
−1 −1 −1 −1 −1 −1 −1

FIG. 19

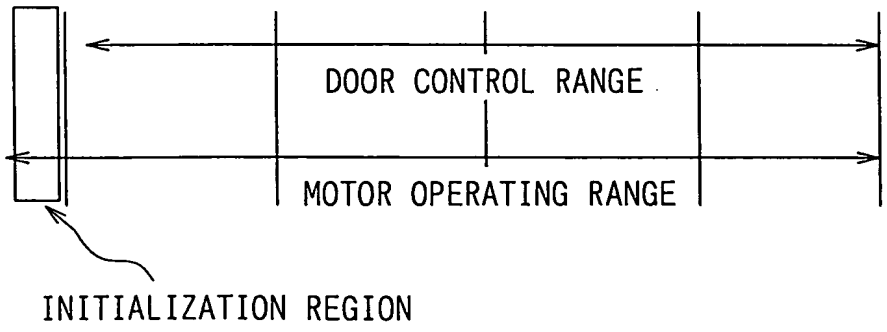

DOOR CONTROL RANGE
MOTOR OPERATING RANGE
INITIALIZATION REGION

FIG. 20

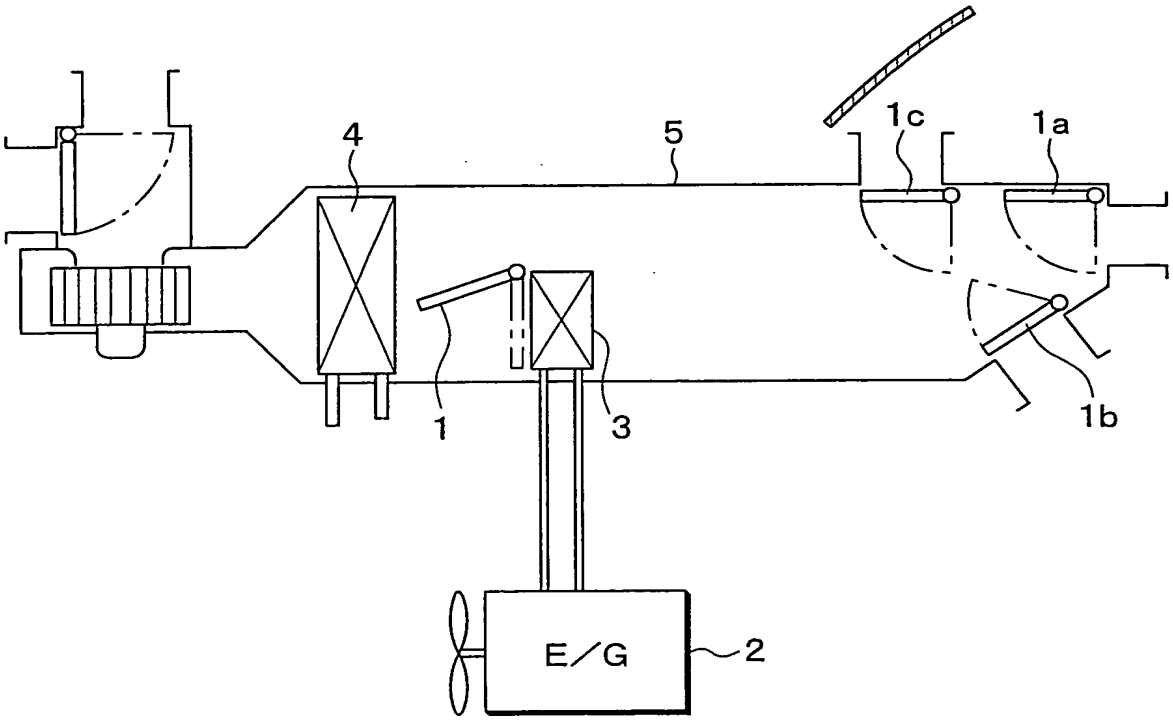

4
5
1c
1a
1
3
1b
E/G
2

FIG. 21

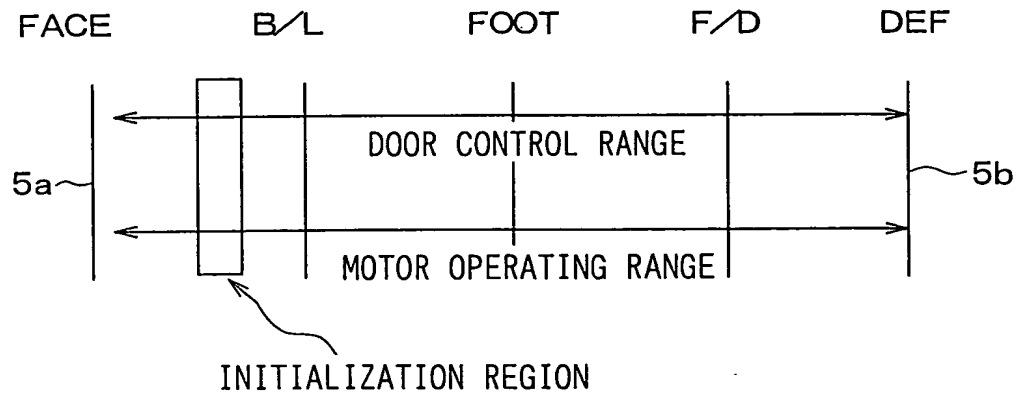

FACE
B/L
FOOT
F/D
DEF
DOOR CONTROL RANGE
MOTOR OPERATING RANGE
5a
5b
INITIALIZATION REGION

FIG. 22

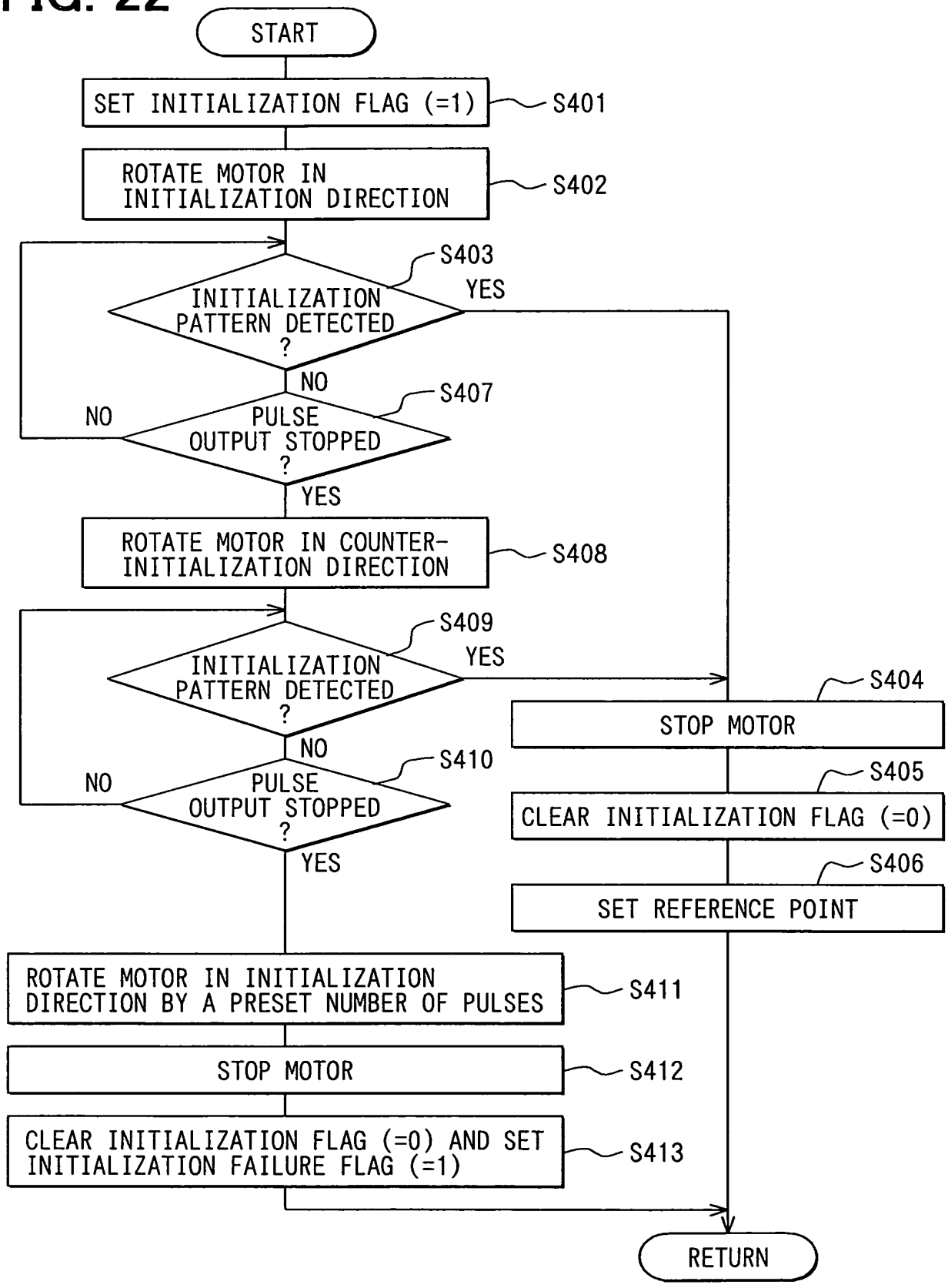

START
SET INITIALIZATION FLAG (=1)
S401
ROTATE MOTOR IN INITIALIZATION DIRECTION
S402
S403
INITIALIZATION PATTERN DETECTED ?
YES
NO
S407
NO
PULSE OUTPUT STOPPED ?
YES
ROTATE MOTOR IN COUNTER-INITIALIZATION DIRECTION
S408
S409
INITIALIZATION PATTERN DETECTED ?
YES
NO
S410
NO
PULSE OUTPUT STOPPED ?
YES
S404
STOP MOTOR
S405
CLEAR INITIALIZATION FLAG (=0)
S406
SET REFERENCE POINT
ROTATE MOTOR IN INITIALIZATION DIRECTION BY A PRESET NUMBER OF PULSES
S411
STOP MOTOR
S412
CLEAR INITIALIZATION FLAG (=0) AND SET INITIALIZATION FAILURE FLAG (=1)
S413
RETURN

FIG. 23A

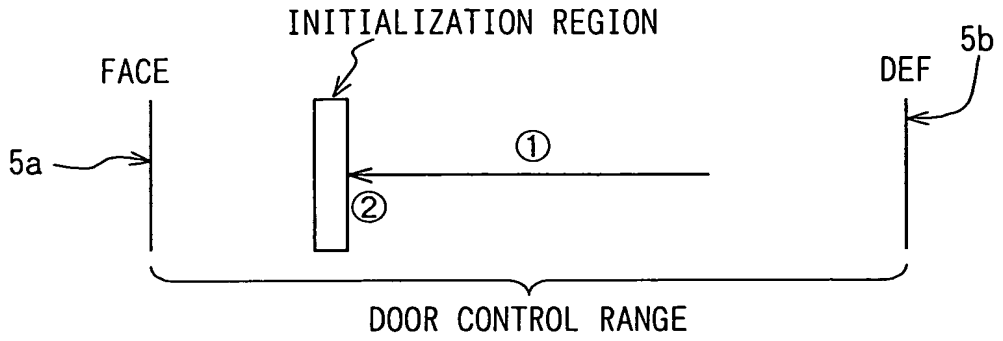


FIG. 23B

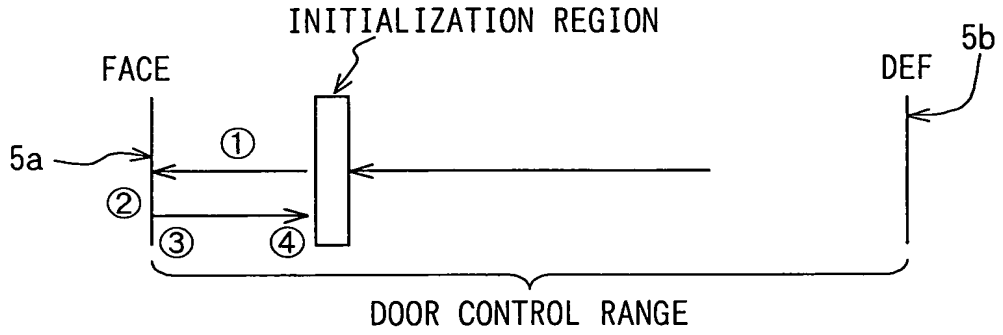


FIG. 23C

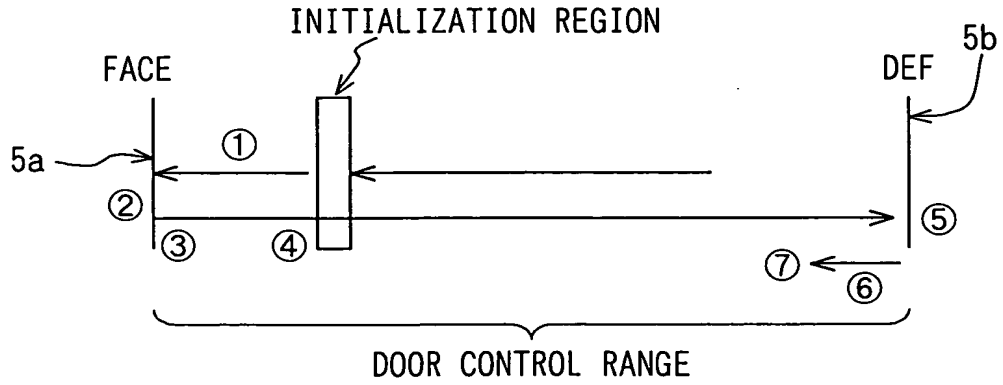


FIG. 24

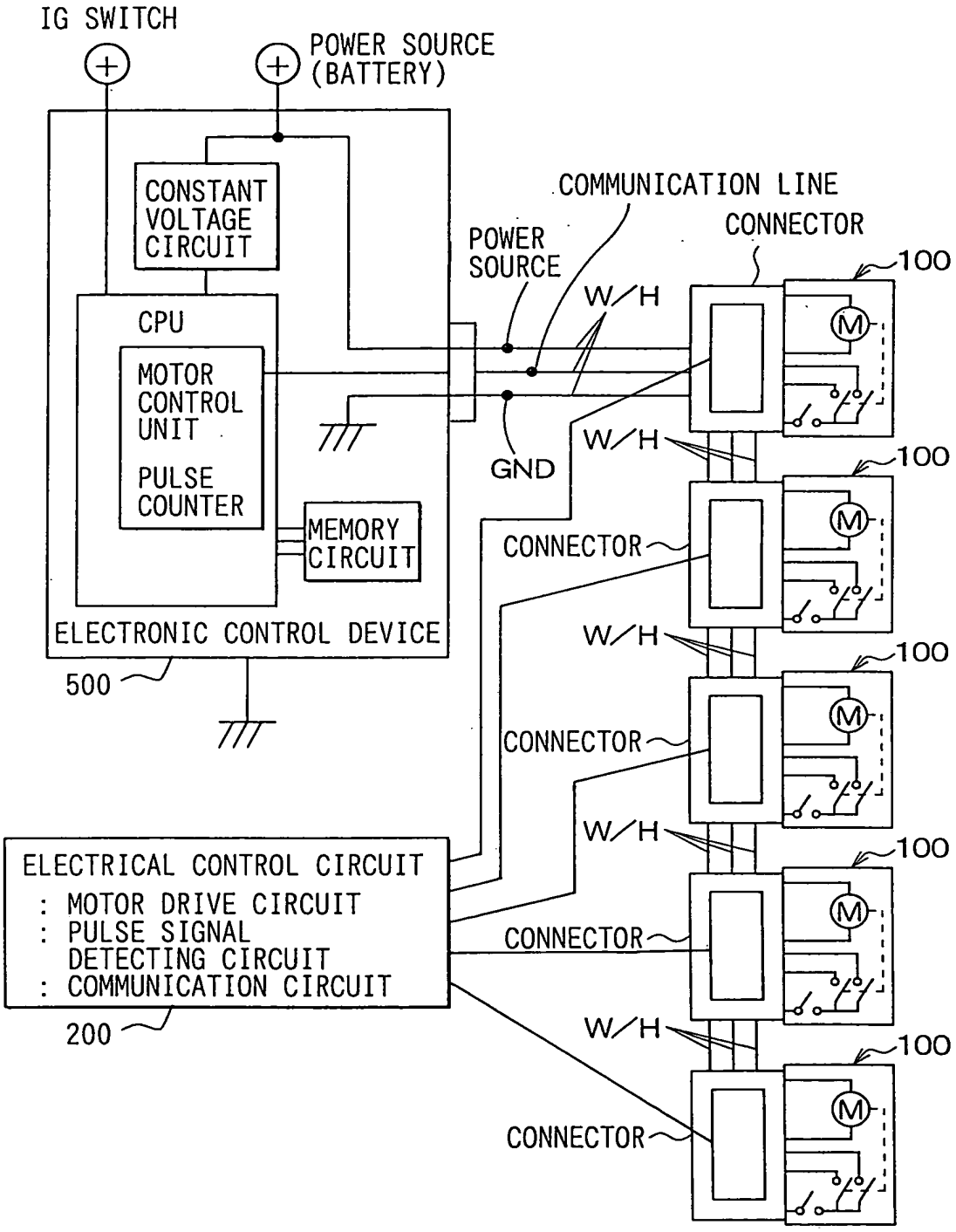

IG SWITCH
POWER SOURCE (BATTERY)
CONSTANT VOLTAGE CIRCUIT
CPU
MOTOR CONTROL UNIT
PULSE COUNTER
MEMORY CIRCUIT
ELECTRONIC CONTROL DEVICE
500
ELECTRICAL CONTROL CIRCUIT
: MOTOR DRIVE CIRCUIT
: PULSE SIGNAL DETECTING CIRCUIT
: COMMUNICATION CIRCUIT
200
POWER SOURCE
GND
COMMUNICATION LINE
CONNECTOR
W/H
100
M

FIG. 25

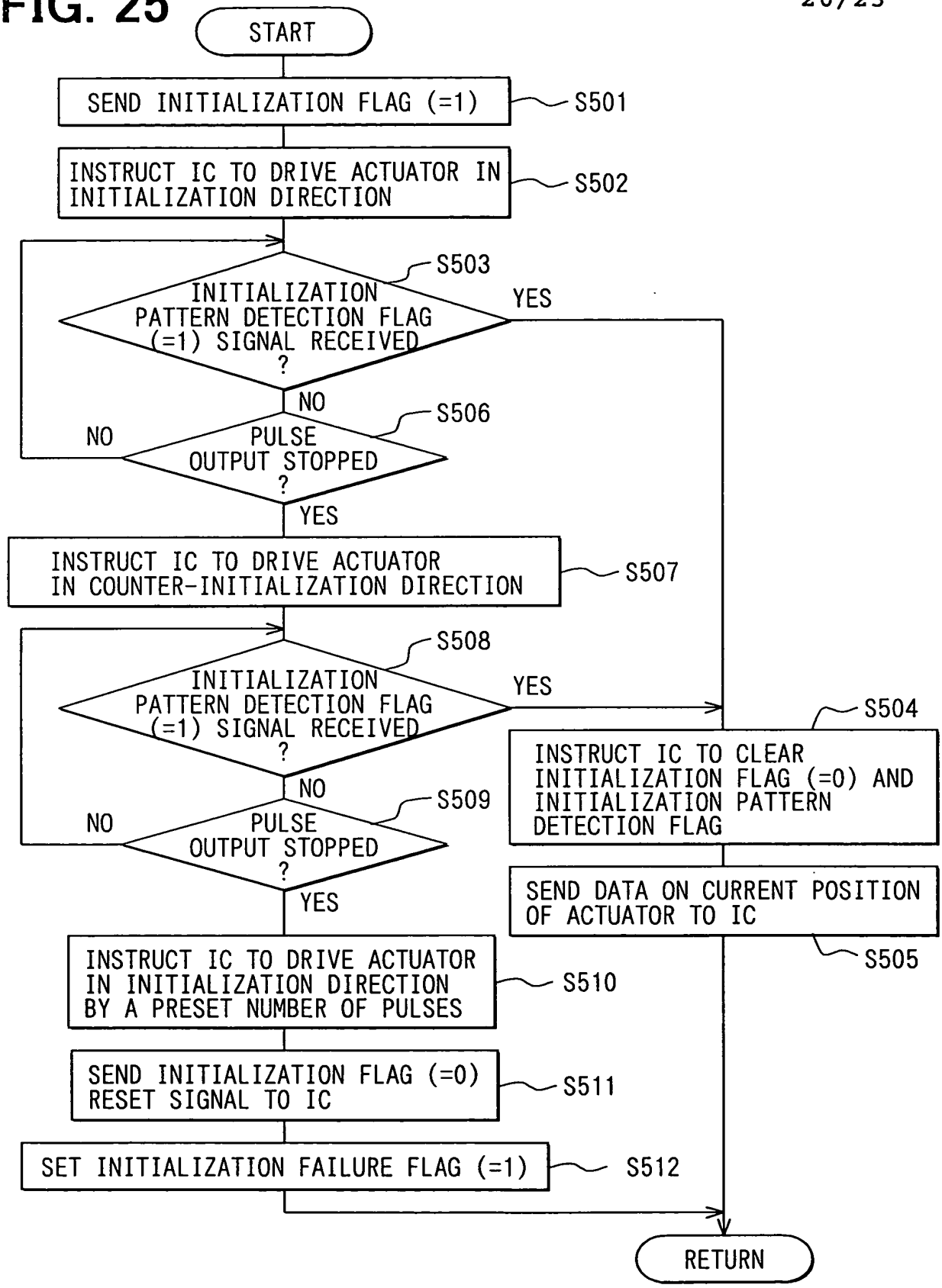

START
SEND INITIALIZATION FLAG (=1)
S501
INSTRUCT IC TO DRIVE ACTUATOR IN INITIALIZATION DIRECTION
S502
S503
INITIALIZATION PATTERN DETECTION FLAG (=1) SIGNAL RECEIVED ?
YES
NO
S506
PULSE OUTPUT STOPPED ?
NO
YES
INSTRUCT IC TO DRIVE ACTUATOR IN COUNTER-INITIALIZATION DIRECTION
S507
S508
INITIALIZATION PATTERN DETECTION FLAG (=1) SIGNAL RECEIVED ?
YES
NO
S509
PULSE OUTPUT STOPPED ?
NO
YES
S504
INSTRUCT IC TO CLEAR INITIALIZATION FLAG (=0) AND INITIALIZATION PATTERN DETECTION FLAG
SEND DATA ON CURRENT POSITION OF ACTUATOR TO IC
S505
INSTRUCT IC TO DRIVE ACTUATOR IN INITIALIZATION DIRECTION BY A PRESET NUMBER OF PULSES
S510
SEND INITIALIZATION FLAG (=0) RESET SIGNAL TO IC
S511
SET INITIALIZATION FAILURE FLAG (=1)
S512
RETURN

FIG. 26

PULSE STATE		INITIALIZATION DIRECTION		COUNTER-INITIALIZATION DIRECTION	
A	B	CURRENT POSITION (PULSE NUMBER)	TARGET POSITION (PULSE NUMBER)	CURRENT POSITION (PULSE NUMBER)	TARGET POSITION (PULSE NUMBER)
0	0	FCh	00h	00h	FFh
0	1	FDh	00h	01h	FFh
1	1	FEh	00h	02h	FFh
1	0	FFh	00h	03h	FFh

FIG. 28

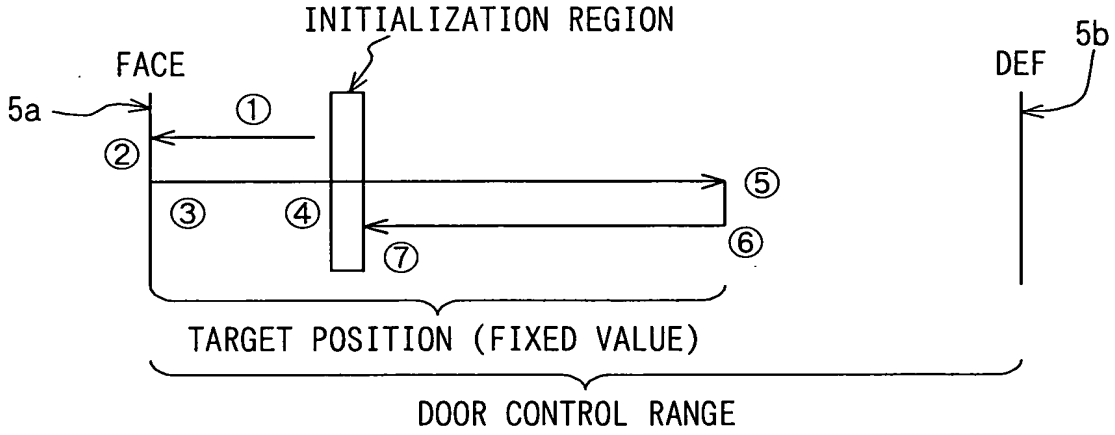


FIG. 29

DOOR	FAIL-SAFE POSITION
AIR MIX	HOT SIDE
BLOWING OPENING	DEF SIDE
AIR INLET	OUTSIDE AIR
COOLING AIR BYPASS	CLOSED

FIG. 27

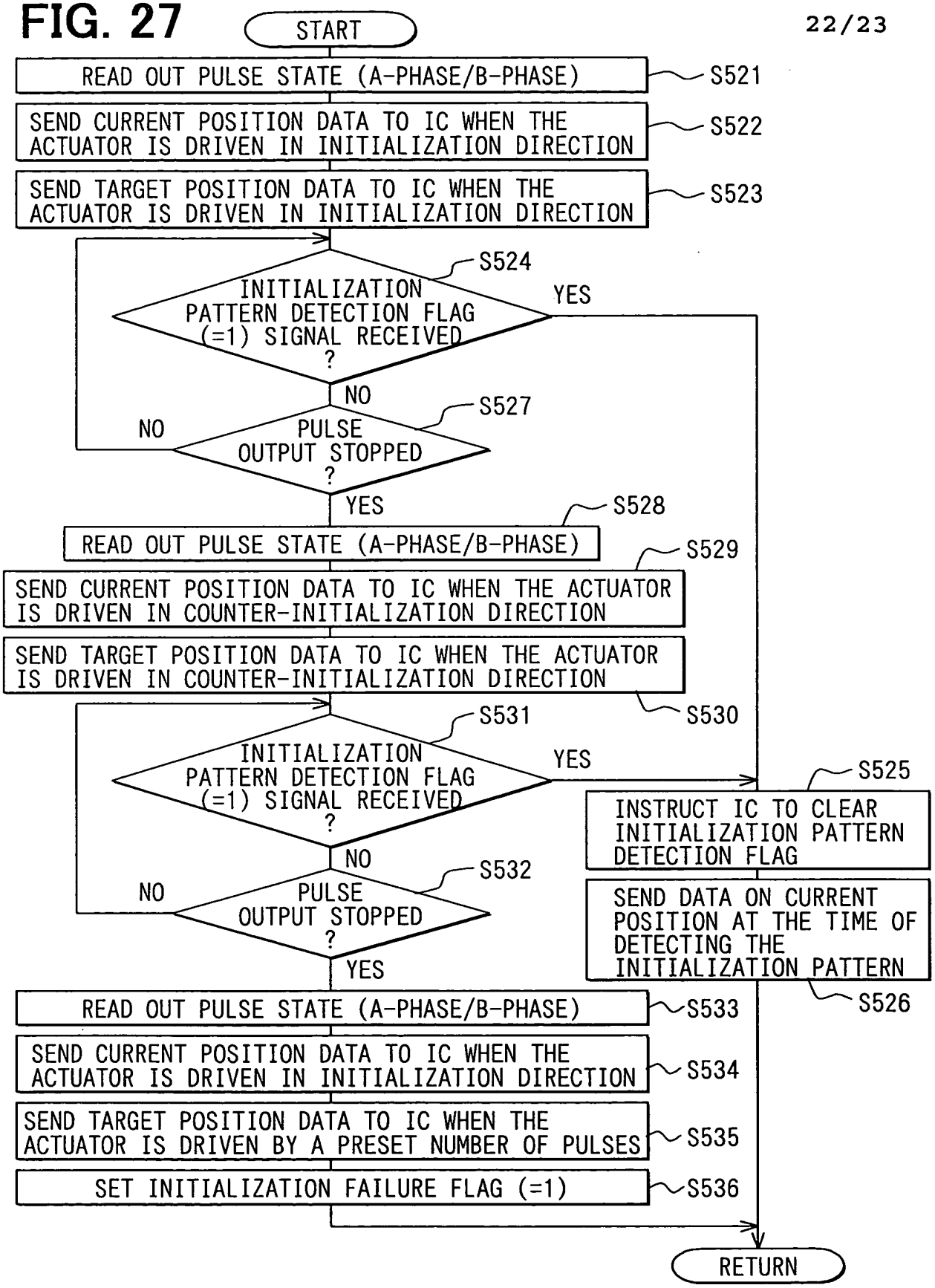
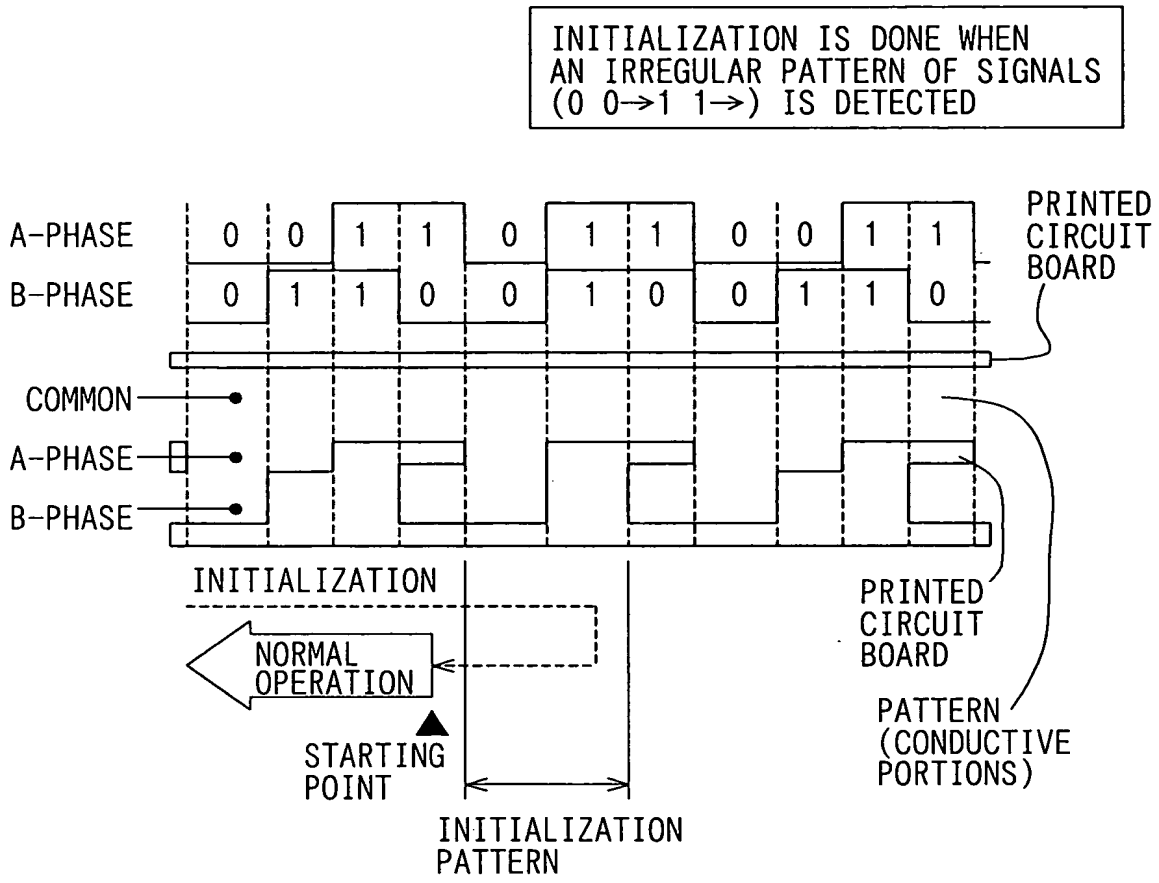

START
READ OUT PULSE STATE (A-PHASE/B-PHASE)
S521
SEND CURRENT POSITION DATA TO IC WHEN THE ACTUATOR IS DRIVEN IN INITIALIZATION DIRECTION
S522
SEND TARGET POSITION DATA TO IC WHEN THE ACTUATOR IS DRIVEN IN INITIALIZATION DIRECTION
S523
S524
INITIALIZATION PATTERN DETECTION FLAG (=1) SIGNAL RECEIVED ?
YES
NO
S527
PULSE OUTPUT STOPPED ?
NO
YES
S528
READ OUT PULSE STATE (A-PHASE/B-PHASE)
S529
SEND CURRENT POSITION DATA TO IC WHEN THE ACTUATOR IS DRIVEN IN COUNTER-INITIALIZATION DIRECTION
SEND TARGET POSITION DATA TO IC WHEN THE ACTUATOR IS DRIVEN IN COUNTER-INITIALIZATION DIRECTION
S530
S531
INITIALIZATION PATTERN DETECTION FLAG (=1) SIGNAL RECEIVED ?
YES
NO
S532
PULSE OUTPUT STOPPED ?
NO
YES
S525
INSTRUCT IC TO CLEAR INITIALIZATION PATTERN DETECTION FLAG
SEND DATA ON CURRENT POSITION AT THE TIME OF DETECTING THE INITIALIZATION PATTERN
S526
READ OUT PULSE STATE (A-PHASE/B-PHASE)
S533
SEND CURRENT POSITION DATA TO IC WHEN THE ACTUATOR IS DRIVEN IN INITIALIZATION DIRECTION
S534
SEND TARGET POSITION DATA TO IC WHEN THE ACTUATOR IS DRIVEN BY A PRESET NUMBER OF PULSES
S535
SET INITIALIZATION FAILURE FLAG (=1)
S536
RETURN

FIG. 30


INITIALIZATION IS DONE WHEN AN IRREGULAR PATTERN OF SIGNALS (0 0→1 1→) IS DETECTED
A-PHASE
B-PHASE
0 0 1 1 0 1 1 0 0 1 1
0 1 1 0 0 1 0 0 1 1 0
PRINTED CIRCUIT BOARD
COMMON
A-PHASE
B-PHASE
INITIALIZATION
NORMAL OPERATION
STARTING POINT
INITIALIZATION PATTERN
PRINTED CIRCUIT BOARD
PATTERN (CONDUCTIVE PORTIONS)